

Soft Architecture: Ambient Responsive Media for Collective and Parallel Play

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ABSTRACT

We describe a prototype testbed for responsive environments built for free, improvisatory play. The demonstration installations are built using elements of the next generation of the media choreography system built for the TGarden project: real-time video and real-time sound synthesis engines, signal-bearing and image-bearing woven materials, fabric-based wireless sensors.

Keywords

Ambient Media, Responsive Media, Play

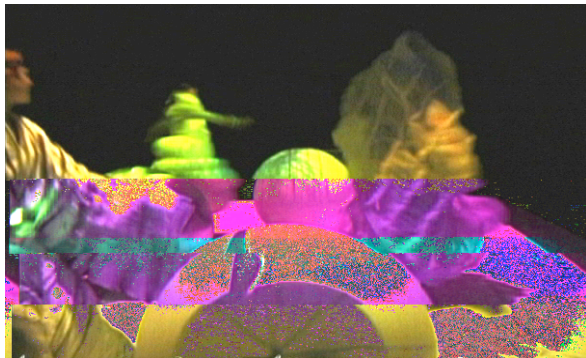


Figure 1. Dancing in TG2001, a prototype TGarden, Rotterdam, The Netherlands.

INTRODUCTION

How can we build play environments that reward repeated visits and ad hoc, social activity? How can we build environments whose appeal does not become exhausted as soon as the player figures out a set of tasks or facts? We are building responsive media spaces that are predicated on rule-based game logic, puzzle-solving or exchange economies [2], but rather on improvisatory yet disciplined behavior. We are interested in building play environments that offer the sort of embodied challenge and pleasure afforded by swimming or by working clay.

A key technical goal of our interface design is to allow people to create and nuance media by gesturing freely. This in turn motivates a second key technical goal which is the construction of responsive systems based on gesture-

rather than gesture-recognition. This radically shortens the computational path between human gesture and media response.

Our environments are built around rich physicalistic response models that sustain the construction of embodied, non-verbal intuition and progressively more virtuosic and expressive performance. The field-based nature of these physicalistic models allow us to sustain collective as well as solo performance with equal ease.

This work is based on 5 years of building responsive installation-events in 10 cities, and is informed by results from experimental theater and electronic musical performance. ([21], [8])

SOCIAL AND ARTISTIC APPLICATION

Taking as our cue and motto that ubiquitous computing places the emphasis on computation rather than computers, i.e. on processes rather than devices, we demonstrate how our ambient responsive media can enhance both parallel and coordinated forms of playful social interaction in semi-public spaces.



Figure 2. Two players tracked in video, tugging at spring projected onto common fabric.

Social phenomenology

Our design philosophy has two roots: experimental theater transplanted to everyday social space, and theories of public space ranging from urban planners ([15], [22]) to playground designers [9].

R. Oldenburg calls for a class of so-called “third spaces,” occupying a social region between the private, domestic spaces and the vanished informal public spaces of classical socio-political theory. These are spaces within which an easier version of friendship and congeniality results from casual and informal affiliation in “temporary worlds dedicated to the performance of an act apart.” [13]

This research concerning ambient “soft architecture” parallels our work with body-based technologies. In that research line, the goal is not to draw attention to the technology but to nuance, enrich or otherwise augment

people's gestures and activity, such as greetings or goodbyes. In the context of soft architecture, we aim to design whole environments, room-scale technologies that act mostly in the background. We accomplish this by designing the substrate, the propensities for response in continuous fields of media. Rather than rely on combinations of fixed props, we rely on people's ability to amuse and entertain one other even without explicitly trying to do so. [22]

Hendricks observed that in designing playgrounds for children one learns that there is no average child, there is no average user. Hendricks de-emphasized props or toys with "hard-wired" uses, and stressed the importance of "re-purposable" media like sand and accessible running water. We follow analogous design strategies in our work with hybrid physical and computational spaces.

Artistic Interest

Emphasizing embodied experience, we appropriately embed responsive visual, aural, tactile media into physical architecture.

We are at the beginning of a research project to people's movement, rhythm, body boundaries, and socially contextualized gestures in augmented environments.

We do not try to project the spectator's attention into an avatar as in Krueger's work [13] and in most virtual or some augmented reality systems. Instead, we focus performer-spectator's attention in the same space as all the co-located inhabitants. Moreover, rather than fixing the user's attention as a spectator media "objects" (icons plus sound effects) projected onto screens, we try to sustain human-human play, using responsive media such as calligraphic, gesture/location-driven video as the medium of shared expression. In this way, we keep the attention of the human inhabitants on one another rather than having them forget each other distracted by a "spectacular" object [6].

Calligraphic video as a special form of time-based media is part of our research into the preconditions for meaning-making in live performance. This research is informed by a long history of experimental research in performance including, among other sources, A. Artaud's call for total theatrical language of superceding textually based narrative, B. Brecht's work on "alienation" effects, and J. Grotowski's decades of performance research work on "physical action" ([17], [4]).

TECHNICAL SIGNIFICANCE

The accompanying video showcases a few elements of our ambient computational media system, developed from the TGarden responsive media spaces. ([20], [21]) In particular, we have constructed real-time, time-based video and sound instruments which can be parameterized by gestures tracked by infra-red or visible light video cameras, or accelerometer, photocell, magnetometer, and pressure/bend sensors on our customized TinyOS wireless motes. [19]

The TGarden is a responsive media space designed for improvisatory play. Briefly, its architecture includes these components: wireless sensors on the body, statistical reduction (on the body and on fixed computers), media choreography (a continuous evolution system based on statistical pseudo-physics), real-time media synthesis engines. [20]

The effort presented in this note is aimed to achieve a much greater degree of expressivity and tangibility in time-based visual, audio, and now fabric media. In the video domain, we use lattice methods as a powerful way to harness models that already simulate tangible natural phenomena. Such models possess the shallow semantics we desire based on our heuristics for technologies of performance. A significant technical consequence is that such methods allow us to scale efficiently (nearly constant time-space) to accommodate multiple players.

We briefly describe these lattice methods since they offer a fair amount of play in our current ambient media installations.

Lattice computation in the physical world

Our lattice operators are modeled after the wave equation:

$$P'' = \text{Laplacian}[P]$$

and the heat equation:

$$P' = \text{Laplacian}[P]$$

Where $P[x,y]$ is a potential function on R^2 , and P' denotes the time-derivative of P . We modified the operator by coefficients on the second order and first order derivatives of P in order to provide degrees of anisotropy and viscosity. Properly tuned, these parameters enable an even more physicalistic response to the people's activity.

Another example is a class of operators that index time on streaming video at the pixel level. Our time-shifting operator can be parameterized by functions of a second stream of video, e.g. processed from live infra-red video tracking data, offering a physicalistic but entirely non-realistic response to people's activity. People invariably played and moved quite differently in concert with these modified dynamics when the media was projected back into their surround physical space.

(See the accompanying video for examples of such operators.[18])

Since the movements and body-projections of the human participants seed the dynamics of our media system, the people themselves are analog, distributed elements of the distributed computation. Thus the people automatically inject liveness and playfulness into their own space.

COMPARISON

After Krueger's pioneering work [12] with video, classical VR systems glue inhabitants' attention to a screen, or a display device and leave the body behind. Augmented reality games like Blast Theory's put some players into the physical city environment, but still pin players' attention to (mobile) screens. [3]

Re-projection onto the surrounding walls and bodies of the inhabitants themselves marks an important return to embodied social, play, but mediated by distributed and tangible computation.

The Influencing Machine is a useful contrasting example of a responsive system. The Influencing Machine sketches doodles apparently in loose reaction to slips of colored paper that participants feed it. This installation is also a non-language-based system, and in fact it is designed ostensibly along “affective” lines. It is interesting to note how published interviews with the participants reveal that they objectify the Influencing Machine as an independent affective agency. They spend more effort puzzling out this machine’s behavior than in playing with one another. [10]

In our design, we aim to sustain environments where the human inhabitants’ attentions are on one another, rather than on a display.

CONCLUSIONS

Continuous models sustain . Rather than disallow or halt on unanticipated user input, our dynamical sound models will always work. However, we leave the and the of the sound to the user.

Continuous models allow , which provides different expressive opportunities than selecting among a relatively small, discrete set of options.

We are prototyping ubiquitous play surfaces via projection onto cloth, the first and most highly evolved form of tangible media.

This in turn is motivated by and informs an investigation of human embodied experience in solo and social situations. We explore technologies that can be used for enlivening or playful applications.

Our appeal to lattice methods coupled with re-projection into physical gestural space is a first approximation to continuous topological media. This represents a significant conceptual shift away from subject-based or ego-based computational logic toward a radically distributed computational agency. One possible consequence of our topological approach is a way to sustain a shared experience of sociality alternative to theories of communication structured according to the “conduit metaphor.” [16] We plan to build more ambient responsive media play spaces to test this conjecture.

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